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less than a fifteenth, of its former extent. The anterior supports are now relaxed, the wing assumes its natural position, the wing-cover closes down upon it, and all is snugly packed away.

Although I have never experimented upon a living earwig, it will be apparent to any one who has attempted to expand a wing rendered flexible by artificial means, that the closure of the wing is produced by the mere elasticity of the parts. It is also altogether analogous to the process of duplicature in the cockroach, as carefully explained by Saussure, and it is difficult to explain the process in any other way. The mode in which they are opened would be much more difficult to understand if it had not been observed by Charpentier and described nearly forty years ago. The contraction of the extensor muscles attached to the hinder set of veins would undoubtedly cause the fan to expand when once the double folding, transverse and longitudinal, had been overcome; but it does not seem possible that they could cope with this difficulty. How then is it done? According to Charpentier, simply by means of the forceps with which the extremity of the abdomen is always provided in both sexes; the tip of the body is bent upward and the forceps used with great rapidity and ease, first on one side and then on the other, as a sort of fingers, to bring the wings into the position which would allow the action of the thoracic muscles upon the base of the principal veins. Nevertheless, it is difficult to conceive how this operation can be performed by those species whose forceps are as long as their body.

COOPER'S HELIX IN COLORADO.

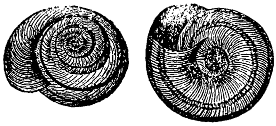
BY E. A. BARBER.

AMONG the Helices, there is perhaps no species which presents greater diversity in form, size, and markings, than *Helix Cooperi.* Until recently, our knowledge has been somewhat limited in regard to this beautiful and interesting western species; but our information has been materially increased of late, by the results of the researches of the United States Geological Survey. During the summers of 1874–75, I found great quantities of these shells throughout Colorado, in a variety of locations, and under variable conditions. I first discovered them in Middle Park, a few miles from the Hot Sulphur Springs, or the settlement known as Grand City, on the head-waters of the Grand or Gunnison River. As we were riding along through a severe hailstorm, we crossed over a hill which was literally covered with white objects, which I at first supposed to be hail-stones, but which I soon perceived were weather-worn shells of this species. Hastily dismounting, I scooped together, from a space scarcely two feet square, over a pint of them, which I carried back to camp for examination. They were so numerous that half a bushel could have been raked together without difficulty in a very short time, but they seemed to be confined to this particular elevated mound. All were dead, being in a dry, exposed situation, and but few of them were worth preserving. This was at an altitude of about 8500 feet, although I have found numbers of these shells just below the timber-line on the summits of mountains, 11,000 feet above tide water. Such specimens were usually more fully developed, although I never found them in a living state above 9500 feet. And here I may add that I have never discovered a single specimen on the eastern or Atlantic slope, and I have yet to see the first sample which was discovered there, although I do not assert that *H. Cooperi* does not occur on this side of the Range.

Along the banks of small streams and springs, in the damp sedge and grass, and in shaded spots, I found many, but rarely more than a dozen together. All of these latter were in a living state, and on extracting the animals from the shells, I found that they were viviparous, nearly every one containing about twenty-five minute, well-formed shells. In the cañons cleft in the mountain sides, among the dank underbrush, the most brilliantly colored specimens were obtained, each being marked with longitudinal or spiral bands of dark red or brown, varying in number from one to five, but usually two. In some instances the entire shells were dark, with the exception of a narrow, bright-colored band.

Through North Park they are abundant, and farther west, along the Bear (or Yampa), White, Grand, and Eagle (Piney Creek) Rivers. Near the South Branch of White River I discovered a locality, on the summit of a high hill, abounding in quantities of a larger variety of this species. The individuals were, some of them, as large as an average *Helix albolabris;* but all of these were empty, and bleached perfectly white. The shells were depressed, and thick and heavy. In the same neighborhood (as in fact, throughout the most of northwestern Colorado), bleached shells are scattered over the surface of the ground in such quantities that the traveler may pick up, almost anywhere, quarts of them. In particular places the soil is strewn so thickly with them that one can scarcely walk without crushing several at every step. Where they occur so numerously the shells are invariably empty and bleached, and in all probability they have been lying in this condition for years. Through burned forests where every tree has been charred, and the underbrush entirely destroyed, they are to be seen, lying on the blackened ground, in even greater quantities than under any other condition. And this I accounted for in the following manner: At certain times of the year the animals bury themselves in the moist earth, and when the forests are fired by the Indians, the heat causes them to come to the surface, where they are destroyed, and their calcareous coverings rendered so brittle that they can be crumbled into an impalpable dust between the thumb and fingers.

Different specimens of *H. Cooperi* often present such a great variety of forms that the collector may frequently become confused in seeking to determine them. Sometimes the spire is exceedingly depressed, when the specimen may be mistaken for *Helix strigosa*, while many others are highly elevated and resemble closely large specimens of *Helix Idahoensis*. Near the Grand River, just above its confluence with Piney Creek, I picked up a reversed specimen, which, among this species, is extremely rare. It must be considered as nothing less than a montrosity, yet is exceedingly interesting in showing to what extreme variation the *H. Cooperi* is subject.



(FIG. 42.) REVERSED SPECIMEN OF HELIX COOPERI.

As we advanced southward we found the representatives of this species decreasing in number and size, until, in the southwest portion of Colorado, they are found only occasionally in the defiles of the Sierra La Plata. The higher elevations seem to be more favorable for the full development of mollusks, being a limestone country, while among the lower sandstones land shells are almost unknown. We find, then, that there are certain conditions of climate, elevation, and locality, which are favorable to the satisfactory growth of the hardy and prolific *H. Cooperi*. It seems to thrive better in a temperate than in a torrid climate. It increases more rapidly in numbers, and even in size, in the medium or higher altitudes. It prefers cool, damp, shaded spots, to warm or dry locations. It appears to be confined to the Pacific slope of the Rocky Mountains; for, if it exists at all on the eastern side, it is only met with in reduced numbers.